PATENT ABSTRACTS OF JAPAN

(54) **DRIFT DETECTION CORRECTION CIRCUIT**

(57)Abstract:

PURPOSE: To obtain a drift detection correction circuit which can detect and automatically covect a drift component included in the difference between two signals and.

CONSTITUTION: Two piezoelectric elements 16a16b of an oscillating gyro 12 are connected to a first differential circuit 34. The output signal of the first differential circuit 34 is synchronously detected by first and second synchronous detection circuits 4050and smoothed by first and second smoothing circuits 4454. The first smoothing circuit 44 is connected to an amplification circuit 58. A difference between output signals of the two smoothing circuits 4454 is output from a second differential circuit 56 and a phase circuit 62 is controlled in response thereto. The phase of a synchronous signal generated in a synchronous signal generation circuit 60 is regulated by the phase circuit 62. The synchronous signals of the two synchronous detection circuits 4050 have the same temporal center point and possess a temporaly symmetrical shape and different time ranges as viewed from the center point.

CLAIMS

[Claim(s)]
[Claim 1]The 1st synchronous detection circuit for carrying out synchronous detection of the output signal of the 1st differential circuit for taking a difference of two signalsand said 1st differential circuitThe 1st smoothing circuit for carrying out smoothness of the output signal of said 1st synchronous detection circuitThe 2nd synchronous detection circuit for carrying out synchronous detection of the output signal of said 1st differential circuitThe 2nd smoothing circuit for carrying out smoothness of the output signal of said 2nd synchronous detection circuitAnd the 2nd differential circuit for taking a difference of an output signal of said 1st smoothing circuit and an output signal of said 2nd smoothing circuit is includedA drift detection correction circuit which said 1st synchronous detection circuit and said 2nd synchronous detection circuit operate

synchronizing with a synchronized signal which has the same time central pointand has a time zone which said two synchronized signals have symmetrical shape in time seen from said central pointand is different.

[Claim 2]Said one synchronized signal consists of one signal including said time central pointA drift detection correction circuit of claim 1 where time width of said one synchronized signal and time width of each signal part of a synchronized signal of said another side are [that said synchronized signal of another side consists of two signal parts which sandwich said one synchronized signal] equal.

[Claim 3]A drift detection correction circuit of claim 1 whose time width of one of said synchronized signal of said each synchronized signal is 1/3 of time width of said synchronized signal of another side including said time central point.

[Claim 4]A drift detection correction circuit of either claim 1 thru/or claim 3 including a phase-shifting circuit for changing a phase of said synchronized signal corresponding to an output signal of said 2nd differential circuit.

[Claim 5]A drift detection correction circuit of either claim 1 thru/or claim 3 including a phase adjustment circuit for adjusting at least one phase of said two signals corresponding to an output signal of said 2nd differential circuit.

[Claim 6]A drift detection correction circuit of either claim 1 thru/or claim 3 including the 3rd differential circuit for taking a difference of an output signal of said 1st smoothing circuitand an output signal of said 2nd differential circuit.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]Especially this invention like the vibration gyroscope and acceleration sensor using a vibration body about a drift detection correction circuitBy taking the difference of two signals including target detecting signaldriving signaletc.it is related with the drift detection correction circuit used for the circuit which measures only the target detecting signal.

[0002]

[Description of the Prior Art]Drawing 21 is an illustration figure showing an example of the vibration gyroscope for detecting the angular rate of rotation by measuring the difference of two output signals. The vibration gyroscope 1 contains the vibration body 2 of right 3 prismatic formsfor example. the side of the vibration body 2 -- the piezoelectric elements 3a3band 3c are mostly formed in the centerrespectively. The variable resister 4 is connected between the piezoelectric element 3a and 3b. The oscillating circuit 5 is connected between this variable resister 4 and piezoelectric element 3c. The signal of this oscillating circuit 5 is given to the piezoelectric elements 3a and 3band the output signal of the piezoelectric element 3c returns to the oscillating circuit 5. By itflexing vibration of the vibration body 2 is carried out in the direction which intersects perpendicularly with a piezoelectric element 3c forming face.

[0003]The piezoelectric elements 3a and 3b are connected to the differential circuit 6. The output signal of this differential circuit 6 is detected in the synchronous detection circuit 7and smoothness is carried out further in the smoothing circuit 8. Since flexing

vibration of the vibration body 2 is carried out in the direction which intersects perpendicularly with a piezoelectric element 3c forming face when the angular rate of rotation is not added to the vibration gyroscope 1both the output signals of the piezoelectric elements 3a and 3b become equal. Since the angular rate of rotation is not added to the vibration gyroscope 1 at this timethis output signal is a driving signal. Howeveractuallysince a difference arises in the output signal of the piezoelectric elements 3a and 3bthe variable resister 4 is adjusted so that the signal inputted into the differential circuit 6 may become the same. Thereforethe output signal of the differential circuit 6 is 0 at this time.

[0004]If the vibration gyroscope 1 rotates the axis of the vibration body 2 as a centerthe direction of the flexing vibration of the vibration body 2 will change by Coriolis forceand a difference will arise to the signal generated in the piezoelectric elements 3a and 3b. Since change of this signal is equivalent to change of the vibrating direction of the vibration body 2the signal generated in the piezoelectric elements 3a and 3b turns into a signal corresponding to the angular rate of rotation. The signal corresponding to this angular rate of rotation has a driving signal and 90-degree phase contrastas shown in drawing 22. Since it generates by the flexing vibration of the vibration body 2the signal corresponding to the angular rate of rotation serves as a sine wave. Since harmonic content is contained in a driving signalthe driving signal serves as a chopping sea. And if the difference of the output signal of the piezoelectric elements 3a and 3b is taken in the differential circuit 6a driving signal will be offset mutually and only the signal corresponding to the angular rate of rotation will be outputted. By carrying out synchronous detection of the right portion or the negative portion of an output signal from this differential circuit 6and carrying out smooththe angular rate of rotation added to the vibration gyroscope 1 is detectable.

[0005]
[Problem(s) to be Solved by the Invention]In such a vibration gyroscopethe variable resister is adjusted so that the output of the differential circuit at the time of nonrotation may be beforehand set to 0. Howeverambient temperature may change or the characteristic of a vibration gyroscope may be changed by aging etc. In such a casea difference arises in the driving signal of two piezoelectric elementsand a driving signal ingredient may be outputted from a differential circuit. When a level difference arises in the driving signal of two piezoelectric elementsas shown in drawing 23electricity can be detected synchronizing with the signal corresponding to the angular rate of rotationand a driving signal ingredient can be offset by carrying out smooth. Howeveras shown in drawing 24when phase contrast arises in the output signal of two piezoelectric elementsthe phase of the driving signal ingredient outputted from a differential circuit shifts. Thereforeeven if it detects electricity and carries out smoothness synchronizing with the signal corresponding to the angular rate of rotationa driving signal ingredient is not offset. This driving signal ingredient serves as a driftand the angular rate of rotation cannot be detected correctly. In such a casea variable resister is readjusted and it is necessary to make it the output from a differential circuit set to 0.

[0006]Although some circuits for controlling such a drift were devisedand it was effective under the conditions that they are specificas prohibitive powerit was not enough. Thereforewhen the minute angular rate of rotation was addeddistinction with the signal and drift corresponding to the angular rate of rotation was not able to be carried out.

[0007]Sothe main purpose of this invention is to provide the drift detection correction circuit which can detect the drift component contained in the difference of two signalsand can be amended automatically.

[0008]

[Means for Solving the Problem]A drift detection correction circuit this invention is characterized by that comprises the following and which operates synchronizing with a synchronized signal and has a time zone which two synchronized signals have symmetrical shape in time seen from the central pointand is different.

The 1st differential circuit for taking a difference of two signals.

The 1st synchronous detection circuit for carrying out synchronous detection of the output signal of the 1st differential circuit.

The 1st smoothing circuit for carrying out smoothness of the output signal of the 1st synchronous detection circuit.

The 2nd synchronous detection circuit for carrying out synchronous detection of the output signal of the 1st differential circuitThe time central point where the 1st synchronous detection circuit and 2nd synchronous detection circuit are the same including the 2nd smoothing circuit for carrying out smoothness of the output signal of the 2nd synchronous detection circuitand the 2nd differential circuit for taking a difference of an output signal of the 1st smoothing circuitand an output signal of the 2nd smoothing circuit.

One synchronized signal consists of one signal including the time central point in this drift detection correction circuitA synchronized signal of another side consists of two signal parts which sandwich one synchronized signaland time width of one synchronized signal and time width of each signal part of a synchronized signal of another side can become equal. It may be made for time width of one synchronized signal to be set to one third of time width of a synchronized signal of another side including the central point where each synchronized signal is time. In order to control a drifta phase-shifting circuit for changing a phase of a synchronized signal corresponding to an output signal of the 2nd differential circuit can be used. In order to control a drifta phase adjustment circuit for adjusting at least one phase of two signals corresponding to an output signal of the 2nd differential circuit may be used. In order to control a driftthe 3rd differential circuit for taking a difference of an output signal of the 1st smoothing circuit and an output signal of the 2nd differential circuit may be used.

[0009]

[Function]The output signal of the 1st differential circuit is detected synchronizing with the synchronized signal which has the same time central point. The shape of these synchronized signals has a time zone which is symmetrical and is different seen from the time central point. If smooth [of the sine wave outputted from the 1st differential circuit synchronizing with these synchronized signals] is detected and carried out and a difference is taken in the 2nd differential circuitthe sine wave outputted from the 1st differential circuit can be offset. One synchronized signal consists of one signal including the time central point at this timeIf the synchronized signal of another side consists of two signal parts which sandwich one synchronized signal and it is made for the time width of one synchronized signal and the time width of each signal part of the synchronized signal of another side to become equalA sine wave can be offset by only taking the difference of the output signal of the 1st smoothing circuitand the output signal

of the 2nd smoothing circuit. If it is made for the time width of one synchronized signal to be set to one third of the time width of the synchronized signal of another side including the central point where each synchronized signal is timeA sine wave can be offset by doubling the signal which detected and carried out smooth synchronizing with one synchronized signaland deducting from the signal which detected and carried out smooth synchronizing with the synchronized signal of another side.

[0010]About harmonic contentif electricity is detected focusing on a zero crossing point synchronizing with an above-mentioned synchronized signaleach other will be offset by carrying out smoothness. Although the output signal of the 1st smoothing circuit is detected as a signal made into the purpose in this circuitfor examplesince the drift containing harmonic content is offsetit can acquire only a required signal. Howeverif synchronous detection of the harmonic content is carried out without centering on a zero crossing pointharmonic content will not be offset but an output signal will be acquired from the 2nd differential circuit. Thereforethe existence of a drift is detectable by the existence of the output signal of the 2nd differential circuit.

[0011]When a signal is outputted from the 2nd differential circuita drift can be controlled corresponding to the signal. For exampleif the phase-shifting circuit for changing the phase of a synchronized signal corresponding to the output signal of the 2nd differential circuit is usedthe detection position in each synchronous detection circuit is changeable. Synchronous detection can be carried out by that cause in the position which can offset harmonic contentand only the target signal can be acquired. If at least one phase of two signals inputted into the 1st differential circuit is adjusted corresponding to the output signal of the 2nd differential circuitit can have a zero crossing point of harmonic content in the position to detectand harmonic content can be offset. If the 3rd differential circuit for taking the difference of the output signal of the 1st smoothing circuit and the output signal of the 2nd differential circuit is usedthe harmonic content which is contained in the output signal of the 1st smoothing circuit and by which smooth was carried out can be removed.

[0012]
[Effect of the Invention]According to this inventioneven if the drift which includes harmonics in the signal inputted into the 1st differential circuit is includedit is detectable by the existence of the output signal of the 2nd differential circuit. Corresponding to the output signal of the 2nd differential circuita drift can be removed and only the target signal can be acquired. Removal of this drift can be performed automatically and there is no necessity for readjustment of a variable resister etc.

[0013]The above-mentioned purpose of this inventionthe other purposesthe featureand an advantage will become still clearer from the detailed explanation of the following examples given with reference to drawings.

[0014]
[Example]Drawing 1 is an illustration figure showing the example which applied the drift detection correction circuit 10 of this invention to the vibration gyroscope 12. The vibration gyroscope 12 contains the vibration body 14 of right 3 prismatic formsas shown in drawing 2. The vibration body 14 is formedfor example with materials which generally produce vibrationsuch as an elinvaran iron nickel alloyquartzglasscrystaland ceramics. three sides of the vibration body 14 -- the piezoelectric elements 16a16band 16c are mostly formed in the centerrespectively. The piezoelectric element 16a contains the

piezoelectric layer 18a which consists of piezoelectric ceramics etc.as shown in drawing 3. The electrodes 20a and 22a are formed in both sides of this piezoelectric layer 18a. And one electrode 22a pastes the vibration body 14 with adhesives etc. Similarlyas for the piezoelectric elements 16b and 16cthe electrodes 20b and 22b and the electrodes 20c and 22c are formed in the both sides including the piezoelectric layers 18b and 18c. And one electrodes 22b and 22c paste the vibration body 14 with adhesives etc.

[0015]The resistance 24 and 26 is connected to the piezoelectric elements 16a and 16brespectively. The oscillating circuit 28 is connected between these resistance 24 and 26 and piezoelectric elements 16c. The oscillating circuit 28 comprises the amplifying circuit 30 and the phase compensator 32. And the output signal of the piezoelectric element 16c returns to the amplifying circuit 30phase correction is carried out further in the phase compensator 32and a signal is given to the piezoelectric elements 16a and 16b. With this signalflexing vibration of the vibration body 14 is carried out in the direction which intersects perpendicularly with a piezoelectric element 16c forming face.

[0016]The piezoelectric elements 16a and 16b are connected to the 1st differential circuit 34. The outgoing end of the 1st differential circuit 34 is connected to the 1st synchronous detection circuit 40 via the capacitor 36 and the resistance 38. As the 1st synchronous detection circuit 40FET42 is usedfor example. In this caseFET42 is connected between the resistance 38 and the halfway point of power supply voltage. The 1st synchronous detection circuit 40 is connected to the 1st smoothing circuit 44. Thereforewhen FET42 is an OFF statethe output signal of the 1st differential circuit 34 is inputted into the 1st smoothing circuit 44.

[0017]The outgoing end of the 1st differential circuit 34 is connected to the 2nd synchronous detection circuit 50 via the capacitor 46 and the resistance 48. As the 2nd synchronous detection circuit 50FET52 is usedfor example. In this caseFET52 is connected between the resistance 48 and the halfway point of power supply voltage. The 2nd synchronous detection circuit 50 is connected to the 2nd smoothing circuit 54. Thereforewhen FET52 is an OFF statethe output signal of the 1st differential circuit 34 is inputted into the 2nd smoothing circuit 54. And the output signal of the 1st smoothing circuit 44 and the output signal of the 2nd smoothing circuit 54 are inputted into the 2nd differential circuit 56. The output signal of the 1st smoothing circuit 44 is inputted into the amplifying circuit 58.

[0018]In order to obtain the synchronized signal for the 1st synchronous detection circuit 40 and the 2nd synchronous detection circuit 50the synchronizing signal generation circuit 60 is used. The output signal of the amplifying circuit 30 is inputted into the synchronizing signal generation circuit 60 via the phase-shifting circuit 62. The phase of the signal which the output signal of the 2nd differential circuit 56 is inputtedand is inputted into the synchronizing signal generation circuit 60 corresponding to the signal is adjusted to the phase-shifting circuit 62. Therebythe phase of the synchronized signal generated in the synchronizing signal generation circuit 60 is adjusted. The synchronized signal obtained in the synchronizing signal generation circuit 60 is inputted into the gate of FET42 and FET52. Thereforethe output signal of the 1st differential circuit 34 is detected synchronizing with the synchronized signal obtained in the synchronizing signal generation circuit 60.

[0019]By the oscillating circuit 28the vibration body 14 of the vibration gyroscope 12 carries out flexing vibration in the direction which intersects perpendicularly with the

forming face of the piezoelectric element 16c. When the angular rate of rotation is not added to the vibration gyroscope 12the output signal of the piezoelectric elements 16a and 16b is the same. Since the angular rate of rotation is not added to the vibration gyroscope 12 at this timethis output signal is a driving signal. And if the vibration gyroscope 12 rotates the axis of the vibration body 14 as a centerthe direction of the flexing vibration of the vibration body 14 will change by Coriolis force. Therebya mutually different signal occurs in the piezoelectric elements 16a and 16b. Since change of this signal is equivalent to change of the vibrating direction of the vibration body 14the signal generated in the piezoelectric elements 16a and 16b turns into a signal corresponding to the angular rate of rotation. Since it generates by the flexing vibration of the vibration body 14the signal corresponding to the angular rate of rotation is a sine wave.

[0020]From the 1st differential circuit 34the difference of the output signal of the piezoelectric elements 16a and 16b is outputted. Synchronous detection of the output signal of the 1st differential circuit 34 is carried out in the 1st synchronous detection circuit 40 and 2nd synchronous detection circuit 50. The synchronized signal for detecting electricity is generated in the synchronizing signal generation circuit 60. As a synchronized signal given to the 1st synchronous detection circuit 40as shown in drawing 4it is formed from two signal parts. These two signal parts are the signals corresponding to one third of the order for 1/2 cycle of the signal corresponding to the angular rate of rotation outputted from the 1st differential circuit 34respectively. Thereforein the 1st synchronous detection circuit 40as shown in drawing 5parts for two 1/6 cycle of the signal corresponding to the angular rate of rotation are detected.

[0021]As a synchronized signal given to the 2nd synchronous detection circuit 50as shown in drawing 6it is the portion pinched by two signal parts of the synchronized signal given to the 1st synchronous detection circuit 40. Thereforein the 2nd synchronous detection circuit 50as shown in drawing 7a part for one 1/6 cycle of the signal corresponding to the angular rate of rotation is detected. And the signal detected in the 2nd synchronous detection circuit 50 is the portion pinched by the signal detected in the 1st synchronous detection circuit 40.
The peak of amplitude is included.
When it divides a sine wave into 1/6 cycle at a timethe area of the range of 1/6 cycle centering on the peak of amplitude and the total area of the range of 1/6 cycle before and behind that become equal. Thereforeif smooth [of the signal shown in drawing 5 and drawing 7] is carried out in the smoothing circuits 44 and 54 and a difference is taken in the 2nd differential circuit 56each other will be offset mutually and the output signal of the 2nd differential circuit 56 will be set to 0.

[0022]If the portion in which a sine wave carries out a zero crossing is detected as a center as shown in drawing 8from the 1st synchronous detection circuit 40 and 2nd synchronous detection circuit 50the signal of the positive/negative which serves as point symmetry focusing on a zero crossing point will be outputted. And the output signal of the 2nd synchronous detection circuit 50 is the portion pinched with the output signal of the 1st synchronous detection circuit 40. Since it consists of a portion of the positive/negative which has the respectively same areathe output signal of the two synchronous detection circuits 40 and 50 is offset by carrying out smoothness of these. Thereforethe output signal of the 1st smoothing circuit 44 and the 2nd smoothing circuit

54 is set to 0. Thereforethe output signal of the 2nd differential circuit 56 is set to 0.

[0023]As shown in drawing 9when the portion [point / zero crossing] shifted is detected as a centerfrom the 1st synchronous detection circuit 40the range for 1/6 cycle is outputted to a negative side from the range and zero crossing point for 1/6 cycle centering on the peak of the amplitude by the side of right. From the 2nd synchronous detection circuit 50the range for 1/6 cycle is outputted to a right side from a zero crossing point. Thereforefrom the 1st smoothing circuit 44the direct current signal equivalent to one half of the area of the right portion of the output signal of the 1st synchronous detection circuit 40 is outputted. From the 2nd smoothing circuit 54the same direct current signal as the 1st smoothing circuit 44 is outputted. Thereforethe output signal from the 2nd differential circuit 56 is set to 0. Thusthe sine wave signal corresponding to the angular rate of rotation is not outputted from the 2nd differential circuit 56.

[0024]About the second harmonicsas shown in drawing 10when a zero crossing point is detected as a centerone third of ranges are outputted from the 1st synchronous detection circuit 40 approximately for one cycle. From the 2nd synchronous detection circuit 50the range for 1/3 cycle is outputted focusing on a zero crossing point. Since a right portion and a negative portion are the same areathe output signal of the 1st synchronous detection circuit 40 is offset by carrying out smoothness in the 1st smoothing circuit 44. Since a right portion and a negative portion are the same areathe output signal of the 2nd synchronous detection circuit 54 is also offset by carrying out smoothness in the 2nd smoothing circuit 54. Thereforethe output signal of the two smoothing circuits 44 and 54 is set to 0and the output signal of the 2nd differential circuit 56 is also set to 0.

[0025]About the 3rd harmonicsas shown in drawing 11when a zero crossing point is detected as a centerone third of ranges are outputted from the 1st synchronous detection circuit 40 approximately for 1.5 cycles. From the 2nd synchronous detection circuit 50the range for 1/2 cycle is outputted focusing on a zero crossing point. Since a right portion and a negative portion are the same areathe output signal of the 1st synchronous detection circuit 40 is offset by carrying out smoothness in the 1st smoothing circuit 44. Since a right portion and a negative portion are the same areathe output signal of the 2nd synchronous detection circuit 54 is also offset by carrying out smoothness in the 2nd smoothing circuit 54. Thereforethe output signal of the two smoothing circuits 44 and 54 is set to 0and the output signal of the 2nd differential circuit 56 is also set to 0.

[0026]Thusif a zero crossing point is detected as a center also about harmonic contentthe output signal of the two smoothing circuits 44 and 54 will be set to 0. Thereforethe output signal from the 2nd differential circuit 56 is also set to 0. Since the driving signal for carrying out flexing vibration of the vibration body 14 of the vibration gyroscope 12 contains such harmonic contentit serves as a chopping sea. Howeverwhen harmonic content is detected considering a zero crossing point as a centeras shown in drawing 12a driving signal is also detected considering a zero crossing point as a center. At this timethe signal with which the output signal of the 1st synchronous detection circuit 40 also has the area whose right portion and negative portion of the output signal of the 2nd synchronous detection circuit 50 are equal is outputted. Thereforea driving signal will be offset if smoothness is carried out in the two smoothing circuits 44 and 54. That issince all harmonic content is offsetthe driving signal containing them will also be offset. Since the signal corresponding to the angular rate of rotation has a driving signal and 90-degree phase contrast at this timefrom the 1st differential circuit 34only a right portion is

outputtedfor example. As drawing 6 explained the output signal of this 1st differential circuit 34one half of the area of the right portion of a sine wave is detected in the 1st synchronous detection circuit 40. Thereforeif smooth [of the output signal of the 1st synchronous detection circuit 40] is carried out in the 1st smoothing circuit 44 and it amplifies in the amplifying circuit 58the large output signal corresponding to the angular rate of rotation can be acquired.

[0027]When electricity is detected without centering the second harmonics on a zero crossing pointas shownfor example in drawing 13from the 1st synchronous detection circuit 40a part for 1/3 cycle centering on a part for 1/3 cycle and ******** of a right portion is outputted. From the 2nd synchronous detection circuit 50a part for 1/3 cycle of a negative portion is outputted. In the output signal of the 1st synchronous detection circuit 40each other is offsetsmoothness of the portion for 1/3 cycle of a right portion is carried outand smoothnessthen the portion with equal positive/negative serve as a dc output. About the output signal of the 2nd synchronous detection circuit 50smoothness of the part for smoothnessthen 1/3 cycle of a negative portion is carried outand it becomes a dc output. Thereforeif the difference of the output signal of the smoothing circuits 44 and 54 is taken in the 2nd differential circuit 56a positive direct current signal will be outputted.

[0028]As shown in drawing 14if the peak of the amplitude of a negative side is detected as a centerfrom the 1st synchronous detection circuit 40two right portions will be outputted in the second harmonics. One negative portion is outputted from the 2nd synchronous detection circuit 50. Thereforeif smoothness of the output signal of the 1st synchronous detection circuit 40 is carried outthe positive direct current signal which corresponds the twice of the area for 1/2 cycle will be acquired. If smoothness of the output signal of the 2nd synchronous detection circuit 50 is carried outthe negative direct current signal equivalent to the area for 1/2 cycle will be acquired. Thereforeif the difference of the output signal of the two smoothing circuits 44 and 54 is taken in the 2nd differential circuit 56a positive direct current signal corresponding by 3 times the area for 1/2 cycle of the second harmonics will be outputted.

[0029]If the second harmonics are detected in another portion as shown in drawing 15from the 1st synchronous detection circuit 40a part for 1/3 cycle will be outputted centering on the peak of the amplitude by the side of right. From the 1st synchronous detection circuit 40a part for 1/3 cycle is outputted from the peak of the amplitude of a negative side. From the 2nd synchronous detection circuit 50the portion pinched by the signal outputted in the 1st synchronous detection circuit 40 is outputted. Thereforethe positive direct current signal which is equivalent to the area for 1/6 cycle from the peak of smoothnessthen amplitude in the output signal of the 1st synchronous detection circuit 40 is outputted. If smoothness of the output signal of the 2nd synchronous detection circuit 50 is carried outthe negative direct current signal which is equivalent to the area for 1/6 cycle from the peak of amplitude will be outputted. Thereforefrom the 2nd differential circuit 56the positive direct current signal equivalent to the area for 1/3 cycle centering on the peak of the amplitude of the second harmonics is outputted.

[0030]If electricity is detected without centering the 3rd harmonics on a zero crossing pointas shownfor example in drawing 16from the 1st synchronous detection circuit 40the right portion for 1/6 cycle and two negative portions for 1/3 cycle which follows it will be outputted. From the 2nd synchronous detection circuit 50the negative portion for 1/6

cycle and the right portion for 1/3 cycle which follows it are outputted. Thereforethe negative direct current signal which corresponds the output signal of the 1st synchronous detection circuit 40 the twice of the area for 1/3 cycle centering on the peak of smoothnessthen amplitude is acquired. The positive direct current signal which is equivalent to the area for 1/3 cycle centering on the peak of smoothnessthen amplitude in the output signal of the 2nd synchronous detection circuit 50 is acquired. Thereforefrom the 2nd differential circuit 56the negative direct current signal which corresponds by 3 times the area for 1/3 cycle centering on the peak of the amplitude of the 3rd harmonics is outputted.

[0031]Thusif harmonic content does not detect a zero crossing point as a centera direct current signal will be outputted from the 2nd differential circuit 56. This means that the driving signal outputted from the 1st differential circuit is not detected considering a zero crossing point as a centeras shown in drawing 17. From the 1st synchronous detection circuit 40a part for 1/6 cycle is outputted from a zero crossing point a part for 1/6 cycle of a right portionand centering on the peak of the amplitude of a negative side so that drawing 17 may show. From the 2nd synchronous detection circuit 50the negative portion for 1/6 cycle is outputted from a zero crossing point. Thereforeif smoothness of the output signal of the two synchronous detection circuits 40 and 50 is carried out and a difference is takena negative direct current signal will be outputted from the 2nd differential circuit 56.

[0032]That isif the zero crossing point of a driving signal is detected as a centera driving signal can be offset by detecting electricity in the 1st synchronous detection circuit 40and carrying out smooth in the 1st smoothing circuit 44. Howeverwhen electricity is detected without centering on the zero crossing point of a driving signala driving signal ingredient will be contained in the output signal of the 1st smoothing circuit 44. Since a signal is outputted from the 2nd differential circuit 56 at this timecorresponding to this signala driving signal ingredient is removable.

[0033]In this examplethe phase-shifting circuit 62 is used as a compensation means. In the phase-shifting circuit 62the phase of the signal inputted into the synchronizing signal generation circuit 60 is adjusted. Therebythe phase of the synchronized signal outputted from the synchronizing signal generation circuit 60 is adjusted. By adjusting the phase of a synchronized signalthe detection position in the 1st synchronous detection circuit 40 and 2nd synchronous detection circuit 50 is adjusted. That isthe phase of a synchronized signal is adjusted so that the zero crossing point of a driving signal may be detected as a center. Thereforea driving signal ingredient is not contained in the output signal of the 1st smoothing circuit 44but only the signal corresponding to the angular rate of rotation can be taken out.

[0034]As shown in drawing 18it may replace with a phase-shifting circuit and the phase adjustment circuit 64 may be attached to the piezoelectric element 16a side. In this examplethe phase of the signal given to the piezoelectric element 16a from the oscillating circuit 28 is adjusted corresponding to the output signal of the 2nd differential circuit 56. The zero crossing point of the driving signal outputted from the 1st differential circuit 34 is adjusted by it so that the lead in synchronous detection may be taken. Thereforeonly the signal corresponding to the angular rate of rotation can be taken out by detecting the driving signal included in the output signal of the 1st differential circuit 34 in the 1st synchronous detection circuit 40and carrying out smooth in the 1st smoothing circuit 44.

[0035]As shown in drawing 19the difference of the output signal of the 1st smoothing circuit 44 and the output signal of the 2nd differential circuit 56 may be measured using the 3rd differential circuit 66. Since the signal corresponding to the angular rate of rotation which is a sine wave is not included in the output signal of the 2nd differential circuit 56it is only a driving signal ingredient. Thereforeif the output signal of the 2nd differential circuit 56 is deducted from the output signal of the 1st smoothing circuit 44only the signal corresponding to the angular rate of rotation can be taken out. In order to set the level of a driving signal ingredient and the level of the output signal of the 2nd differential circuit 56 which are contained in the output signal of the 1st smoothing circuit 44 at this timethe level adjustment circuit 68 may be used.

[0036]Although the synchronized signal which consists of two signal parts was used as a synchronized signal for the 1st synchronous detection circuit 40 in the above-mentioned exampleas shown in drawing 20the signal which detects parts for all 1/2 cycle of the signal corresponding to the angular rate of rotation may be used. In this casefrom the output signal of the 1st smoothing circuit 44the direct current signal which is equivalent to the area of the right portion of the signal corresponding to the angular rate of rotationfor example is outputted. From the 2nd smoothing circuit 54the direct current signal equivalent to one half of the area is outputted to it. Thereforewhat is necessary is just to adjust in the 2nd differential circuit 56so that the twice of the output signal of the 2nd smoothing circuit 54 may be deducted from the output signal of the 1st smoothing circuit 44. If it does in this wayfrom the 2nd differential circuit 56the signal corresponding to the angular rate of rotation will not be outputtedbut only a driving signal ingredient will be outputted. And a drift can be amended using the circuit shown in drawing 1drawing 18and drawing 19. And the signal corresponding to the angular rate of rotation outputted from the 1st smoothing circuit 44 becomes largeand good sensitivity can be obtained.

[0037]Thusthe time width of the detection in the 1st synchronous detection circuit 40 and 2nd synchronous detection circuit 50 can be arbitrarily changed by adjusting the 2nd differential circuit 56. Howeverthe shape of the synchronized signal is symmetrical seen from the time central pointand it is necessary to make it the time zones of the synchronized signal of the two synchronous detection circuits 40 and 50 differ.

[0038]In an above-mentioned examplealthough the drift detection correction circuit 10 of this invention was applied to the vibration gyroscopeit is applicable to the acceleration sensor using a piezoelectric transduceretc.for example. That isin the circuit which detects the difference of two signalsthe leakage of signals other than the signal made into the purposeetc. can be detected and amended.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a circuit diagram showing one example of this invention.
[Drawing 2]It is a perspective view showing an example of the vibration gyroscope with which the drift detection correction circuit shown in drawing 1 is applied.
[Drawing 3]It is a sectional view of the vibration gyroscope shown in drawing 2.
[Drawing 4]It is a graph which shows the relation between the signal corresponding to

the angular rate of rotationand the synchronized signal of the 1st synchronous detection circuit.

[Drawing 5]It is a graph when the signal corresponding to the angular rate of rotation is detected synchronizing with the synchronized signal shown in drawing 4.

[Drawing 6]It is a graph which shows the relation between the signal corresponding to the angular rate of rotationand the synchronized signal of the 2nd synchronous detection circuit.

[Drawing 7]It is a graph when the signal corresponding to the angular rate of rotation is detected synchronizing with the synchronized signal shown in drawing 6.

[Drawing 8]It is a graph which shows the output signal of the 1st and 2nd synchronous detection circuits when synchronous detection of the sine wave is carried out a center [a zero crossing point].

[Drawing 9]It is a graph which shows the output signal of the 1st and 2nd synchronous detection circuits when synchronous detection of the sine wave is carried out without centering on a zero crossing point.

[Drawing 10]It is a graph which shows the output signal of the 1st and 2nd synchronous detection circuits when synchronous detection of the second harmonics is carried out a center [a zero crossing point].

[Drawing 11]It is a graph which shows the output signal of the 1st and 2nd synchronous detection circuits when synchronous detection of the 3rd harmonics is carried out a center [a zero crossing point].

[Drawing 12]It is a graph which shows the output signal of the 1st and 2nd synchronous detection circuits when synchronous detection of the driving signal is carried out a center [a zero crossing point].

[Drawing 13]It is a graph which shows the output signal of the 1st and 2nd synchronous detection circuits when synchronous detection of the second harmonics is carried out without centering on a zero crossing point.

[Drawing 14]It is a graph which shows the output signal of the 1st and 2nd synchronous detection circuits when synchronous detection of the 3rd harmonics is carried out without centering on a zero crossing point.

[Drawing 15]It is a graph which shows the output signal of the 1st and 2nd synchronous detection circuits when synchronous detection of the second harmonics is carried out without centering on a zero crossing point.

[Drawing 16]It is a graph which shows the output signal of the 1st and 2nd synchronous detection circuits when synchronous detection of the 3rd harmonics is carried out without centering on a zero crossing point.

[Drawing 17]It is a graph which shows the output signal of the 1st and 2nd synchronous detection circuits when synchronous detection of the driving signal is carried out without centering on a zero crossing point.

[Drawing 18]It is a circuit diagram showing other examples of this invention.

[Drawing 19]It is a circuit diagram showing the example of further others of this invention.

[Drawing 20]It is a graph which shows the output signal of the 1st and 2nd synchronous detection circuits when the signal corresponding to the angular rate of rotation is detected using other synchronized signals.

[Drawing 21]It is a block diagram showing the circuit of the conventional vibration

gyroscope used as the background of this invention.

[Drawing 22]It is a graph which shows the output signal of the piezoelectric element of the vibration gyroscope shown in drawing 21.

[Drawing 23]It is a graph which shows the output signal of a differential circuit in case the output signal of the piezoelectric element of the vibration gyroscope shown in drawing 21 has a level difference.

[Drawing 24]It is a graph which shows the output signal of a differential circuit in case the output signal of the piezoelectric element of the vibration gyroscope shown in drawing 21 has phase contrast.

[Description of Notations]

10 Drift detection correction circuit

12 Vibration gyroscope

14 Vibration body

16a16band 16c Piezoelectric element

28 Oscillating circuit

34 The 1st differential circuit

40 The 1st synchronous detection circuit

42 FET

44 The 1st smoothing circuit

50 The 2nd synchronous detection circuit

52 FET

54 The 2nd smoothing circuit

56 The 2nd differential circuit

60 Synchronizing signal generation circuit

62 Phase-shifting circuit

64 Phase adjustment circuit

66 The 3rd differential circuit